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ABSTRACT

The purpose of this study was to determine the effect of training teachers in the use of strategies for content development through classroom communication behaviors, to determine the discriminatory power of the Content Analysis System, and to describe some of the relationships of content development characteristics and interaction characteristics. Inservice teachers were trained in the Content Analysis System and in strategies of content sequences, including enumeration, deductive and inductive organizations for identifying and classifying, defining sequences, process analysis, and comparison and contrast. Pre- and post-audio recordings of class sessions by the experimental teachers were coded by means of the Flanders System of Interaction Analysis and the Content Analysis System and were compared with data from a control group. Findings were that: 1) Changes in observed behaviors suggest training effect. 2) Content patterns can be identified by the Content Analysis System. 3) Interaction cycles and content development patterns are interrelated. (RT)

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CHANGE OF CONTENT DEVELOPMENT PATTERNS OBSERVED IN CLASSROOM COMMUNICATION BEHAVIORS DUE TO IN-SERVICE TRAINING IN CONTENT STRATEGIES

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INTRODUCTION

This study concerned the elements, sequences, and organization of subject matter content in the communication behaviors of participants in the classroom. It was the purpose of the study: to determine whether teachers can be trained to use content development sequences in their classrooms. to improve the potential of the content analysis observation instrument to identify content development sequences. to identify some of the interrelationships between interaction communication behaviors as categorized by the Flanders system (1)* and communication behaviors concerned with subject matter content as categorized by the Content Analysis System. (12)

A basic scheme of five categories, Background, Naming, Defining, Examples, and Amplification used in the Content Analysis System was first developed and tested by Duncan and Hough (12,6) in 1966. Following studies (12), (13) were undertaken to refine and develop the C. A. System so that it would be discriminating over a wide range of knowledge areas and instructional strategies and so that the system would be procedurally compatible with the Flanders system of Interaction Analysis.

The Content Analysis System

The Content Analysis System is fundamentally a five category system for the observation and coding of communication behaviors in the classroom which are concerned with subject matter content. Certain sub-divisions within the five main categories together with the Miscellaneous category and the sub-category vivid result in fifteen coding categories of the instrument.

The C.A. System is a general system which can be used to codify content development elements and sequences of communication regardless of the specific topic or subject matter area. Though there is some evidence that different subject matter areas affect the category usage (13), there is considerable evidence that any topic or subject can be classified with the system. For instance, there is evidence of observer reliability in the observation of class situations that deal with language arts and mathematics at the elementary level, mathematics, English, social studies, and science at the junior high school level, and home economics, health science, mechanical drawing, art, English, and advanced algebra at the senior high school level.

* Numbers within parenthesis are used to refer to reference sources in the Bibliography. The first number refers to the number of the reference in the Bibliography. Subsequent numbers, if present, refer to page numbers.

SUMMARY OF CATEGORIES FOR CONTENT ANALYSIS

NON-CONTENT COMMUNICATION	M -	Miscellaneous: All non-content communication. Includes class management, procedure, control authority, personal, and social-emotional communications.
CONTENT COMMUNICATION / FIGURE / GROUND	B -	Background: All classroom communication which develops information or knowledge of the context or frame of reference within which the content idea, topic, or figure is set. This category also includes reference to previously presented subject matter content, that content, learned in past class sessions.
Naming	N -	Naming: All communication behavior which identifies or specifies the topic or content figure by name, symbol, or image.
Defining	D -	Defining: Determines the precise significance or meaning of the figure, the idea or concept under consideration. Includes definition of terms used in the concept or figure.
		Conceptual definitions summarize the meaning of a concept or principle.
		Operational definitions summarize how a process or activity is to be accomplished.
	D<	Definitions without closure: Hypotheses represent definitions yet to be verified and should be coded D<
Examples	E -	General Examples: The presentation or development of elements or examples of the figure which are of a very general or construct nature. Such examples deal with the nature of many specific examples.
	Ea -	Abstract Examples: Communication which presents specific examples verbally or symbolically. These have no real or image form as presented.
	Ec -	Concrete Examples: These are specific examples which are presented in a real or image form in communication. Most media and artifacts used in the classroom are classified in this category.
	Ep -	Personal Examples: Examples which have a personal or thematic characteristic. They have an affective quality.

CONTENT COMMUNICATION	RELATIONAL	En - Negative Examples: Specific examples developed through communication which illustrate what the content figure is not.
		A - Amplification: Content communication by which an expansion or enlargement of the focus of attention occurs. Two or more things are compared, contrasted, or related.
		A< - Amplification without closure: "Why" questions and all higher order questions represent a form of amplification without closure.
		A> - Amplification of detail (with closure): Probing questions of clarification represent amplification which seeks or provides detail. Also, after an example has been developed, if discussion follows going over details of the example that discussion should be coded as A>
		An - Digression: Content communication which expands beyond the relevant content figure or background under consideration. This category also includes known incorrect communication behaviors as well as any corrective feedback which might follow such behaviors.
	Sub-category	v - vivid: Used to denote the quality of content ideation or its presentation which makes its communication emphatic or outstanding. This category also includes verbal or non-verbal directions used to call attention to content ideation.

Procedures for Coding with the C. A. System

Through a study of the category definitions, cues, examples, and ground rules, the C. A. System can be used as an instrument for observing and collecting data about the teaching-learning situation in the classroom. Such data may be gathered "live" during the class session or by means of audio or video-tape recordings. In both cases the procedure is the same.

The C.A.system uses a three-second time interval for recordings so that it is compatible in time and data sequence with the Flanders' system and other such instruments for the observation of interaction. In one minute of classroom activity the observer would record a column of twenty content analysis symbols. There are modifications of this procedure owing to the nature of the development of content.

It may be the case that content ideation is not clear to the observer until it is completed or approaching completion. If this problem arizes, the observer may keep track of the time dimension by recording a dot every three seconds until the category becomes clear to him. At that time and for the following intervals, the observer should record the appropriate category symbol. A sequence recorded in this manner might look similar to Figure 1, as follows:

M	.	.	M
M	.	.	M
M	Ea	D	M
M	Ea	D	M
N	Ea	M	M

Figure 1 - Recording for Content

When recording both content development and interaction communication behaviors, the most useful recording and data display form has been the double columns of twenty spaces as shown in Figure 2, below:

I	A
10	M
5	M
5	M
5	B
5	B
4	B
8	B

C	D
N	
N	
N	
Ec	
Ec	
Ec	

I	A
5	A
5	Ea
5	Ea
4	Ea
8	Ea
8	Ea
3	Ea

C	D

Figure 2 - Recording for Interaction (IA), and Content (CD)

If the class session is being coded "live" for both content and interaction characteristics, two observers are necessary and a rigorous attention to timing is necessary for the data to be combined afterwards. If the class session has been taperecorded, a single observer, skilled in both systems, can code one set of data on the first review of the tape and the second set of data during the second review.

Matrices and other data display forms have been developed for both data systems. (13, 34-54)

Validity and the Content Analysis Observation System

Kerlinger (14,507) states that the important clue to the study of validity of

behavioral observation measures would seem to be construct validity. If the variables being measured by the observation procedures are imbedded in a theoretical framework, then the relationships which derive from the theoretical construct can be checked in the observation as evidence of construct validity.

The content analysis system is a category system which operationalizes basic concepts of communication within the theoretical framework of the figure-ground principle of perceptual psychology. The categories of the system can be used to illustrate the elements and organization within a communicated message. A more detailed discussion of this theoretical framework and implications for construct validity using the generally known "faces and vase" figure-ground analogy can be found in a previous study (12, 16).

Further inference about construct validity can be suggested by the similarity of the descriptive character of observation systems which have been derived from different theoretical rationales.

In a previous study (13) the substantive dimensions of the observation instruments of Smith and Meux (17), Bellack and Davitz (3), Taba (18), and the Content Analysis System were discussed and compared. The substantive dimension of the observation systems of Smith and Bellack were developed from the theoretical base of logic (17). The observation system by Taba is subsumed within a theoretical framework of inquiry and thought processes (18). The content analysis system has its theoretical base within perceptual and communication principles. Yet, given these different bases, the four systems can be used to codify very similar phenomena. It would seem to this investigator that the systems by Smith, Bellack, and Taba are used to codify patterns of substantive communication and the content analysis system can be used to codify elements which when connected in sequence can describe those patterns (13,30).

THE PROBLEM

Prior studies (12), (13) by the investigator include the development and improvement of an observation instrument, the Content Analysis System, and the identification of elements and patterns of content development in the communication behaviors in classrooms dealing with four subject matter areas.

One of the findings of the prior research was that of the patterns found in content development through communication behaviors, few of these could be classified in terms of generally known forms of exposition or logical organization. This finding did not seem attributable to the analysis process used or the coding instrument. It was concluded that teachers by-and-large did not employ content development strategies such as classification, comparison and contrast, restructuring, process analysis to any great extent in the organization and sequencing of communication behaviors dealing with subject matter content.

This finding led to the central purpose of the present study, to determine the effect of training of teachers in content development strategies. Could teachers trained in an in-service setting implement certain content organizational plans through initiating, eliciting, and influencing communication behaviors in their own classrooms?

Further emphasis of this study is derived from the first question of training effect. If teachers can implement content development strategies in classroom communication behaviors, is the content analysis observation instrument sufficiently discriminatory to identify the elements and organization of these strategies?

In addition, the study incorporates an examination of the relationships which may exist between interaction characteristics and content development characteristics of classroom communication behaviors. This third phase of the study arises from two concerns. First, the C. A. System was developed to be compatible with the Flanders system. Therefore, the means are available to examine two dimensions of communication behaviors contiguously. Second, the contiguous examination of content development sequences and the interaction sequences may make certain interrelationships evident. For instance, the over-general evidence that teachers talk two-thirds of class time (1, 65) provides little more than the implication that they talk too much. More helpful evidence might reveal: Who provides a definition, the teacher or the student? Who provides the personal example? Do student questions or teacher questions follow an example; could that be due to the nature of the example? Or, does the difference in interaction provide the meaningful difference in the nature of the example?

PROCEDURES

Procedures for Examining Training Effect

In the prior study (12), the classes of eleven of twelve teachers at a junior high school in Franklin County, Ohio, had been video-taped three times over a period of three to four weeks. The subject areas dealt with in the class sessions were science, English, mathematics, and social studies. No training or knowledge about the content analysis system was available to any of the teachers in this sample during the entire period of observations. Teachers were told that it was necessary to observe their classes in as near normal or usual conditions as possible. The only intentional interventions in the class settings were: One, the teacher was asked prior to each class taped to fill in some information on a 5 x 8 card including date, class size, subject, and the topic of the class session. Two, portable video-tape equipment and an operator were present in the room. Data of category usage of the content analysis system from the first and last coded observations were chosen as the "base-line" or control data against which coded observations before and after a training sequence would be compared.

The experimental data was taken from coded classroom observations of eleven professional teachers attending weekly meetings of a semester-long workshop held at a school in Montgomery County, Maryland. The teachers represented elementary, junior high, and senior high class levels. Subject areas included elementary subjects and art, drawing, algebra, science, business, foreign language, and English at the secondary level.

Several weeks prior to the training session on content analysis, each teacher was asked to audio-tape record one or more topic sessions that occurred in his class. Teachers were told to record whatever session they wished in as normal a circumstance as possible and to take note of any media used which might not be obvious from listening to the tape. Teachers were asked not to record periods of silent study or the viewing of movies. Teachers were also asked to record information about dates, class size, and topic on a 5 x 8 card. These recordings were held as pre-training observations.

The Training Program

In the training sequence the conceptual nature of the Content Analysis System was discussed as well as some findings of analysis of class communication behaviors. Each teacher was taught to define and identify written and recorded illustrations of categories of the C. A. system. Teachers learned to use the category symbols to record in columns their interpretation of recorded illustrations but no attention to timing was required.

Teachers were also shown how to use the category symbols to plan the sequence and organization of content elements as a part of making a lesson plan. The function of each category of the system as .t related to content development was discussed.

Several sequences of categories were suggested as "content development strategies" some illustrations of these sequences as content development strategies were:

1. Enumerating is a series of examples in a communication sequence.
2. Deductive identification by enumeration is a larger sequence involving first a general example and then an enumeration of a series of examples which illustrate the general example.
3. Deductive Classification Sequence is, in fact, a combination of several deductive identification sequences. It is apparent when several classes or general examples are presented, definitions of the classes follow, and a series of examples are enumerated which are then related (Amplification) to the appropriate class or general example.
4. Inductive Identification Sequence. An enumeration of examples leads to the identification of a general example or class.
5. Inductive Classification Sequence - an enumeration of examples are contrasted (Amplified) and separated into classes. These classes then are related to or identified as general examples.
6. Definition by Identification - When a definition is sought, an example is supplied.
7. Definition by contrast - When a definition is available, it is tested by supplying a negative example.
8. Classification by Enumeration and Contrast - An inductive or deductive classification sequence which ends with one or several negative examples.
9. Restructuring Sequence - may be inductive - de ductive or deductive-inductive. May deal with identification or classification. For instance, an inductive identification sequence is followed by amplification and re-definition of the general example. This is followed by a deductive identification sequence using the newly defined general example.

10. Process Analysis is a series of components categorized as an enumeration of examples in which amplification is used to relate the components in the process. An illustration might be the process analysis of changing a flat tire, etc.

11. Comparison and Contrast - Is a sequence establishing two or three examples in considerable detail. These may be compared and contrasted (Amplification) during the sequence of their parallel development or at the end after the examples are completed.

Following the training sessions, each teacher was asked to select a time and a topic appropriate to his coming class sessions and to plan a lesson in which he would choose the content elements and arrange them in any pre-planned order which he believed would be appropriate for his class. He was then asked to audio-tape this session and to bring this audio-tape to the following workshop meeting. After the teachers had listened to, shared, and analyzed the tapes, they were turned in to the investigator to be coded and analyzed.

Two members of the group were unable to complete the post-training expectation and no recording was available from them. Two other group members did the post-training session and recording in a foreign language class and the investigator was unable to codify the recordings. The seven remaining pre and post recordings were codified by the investigator using the Flanders' I. A. instrument for one observation run and the C. A. system for the second observation run. A random selection with replacement for two tapes was made one month later for the purpose of checking observer reliability. The pre and post category data for the in-service group served as the experimental sample. The first and last categorized recordings from the previous study served as the control sample.

Design for Examining Training Effect

The schematic representation of the design of this study where "O" represents observation, "T" represents time, and "X" represents treatment is as follows:

O _ _ _ _ O

O X O

T_1 T_2 T_3 T_4

Figure 3 - Non-Equivalent Control Group Design

This represents a Non-equivalent Control Group Quasi-Experimental Design (6,47). Some variations of the design in this study from design 10, discussed by Campbell and Stanley, leave two additional sources of internal invalidity (6,40) questionably controlled. One of these is history and the other is testing. Though this study accounts for equality of the time durations between observations in both groups (3 to 4 weeks), the two sets of observations did not occur contiguously. In fact a considerable time interval elapsed between the two. Second, testing may be questioned because one means for tape-recording a session was considerably more obtrusive than the others. It is also true that a third interim observation in the control group is not being considered in the comparison.

Twelve variables for each group were classified in the pre and post observations by percentage of time each was used. These twelve categories were Background, Naming, Defining, General Examples, Abstract Examples, Concrete Examples, Personal Examples, Negative Examples, Amplification, Digression, vividness, and Miscellaneous. The categories D<, A<, and A> were not identified apart from their main categories of Defining and Amplification.

This plan for comparison was based upon the assumption that training in content elements, sequences, and strategies would effect a change in the usage of categories within a topic session. A related assumption, using zero sum logic, was that if certain percent of category usage was increased as a result of training, other categories would have to decrease in percent of use. With a knowledge of the training emphasis and these two assumptions, the investigator proposed the following outcomes as a result of the training:

1. There would be an increase in the use of the Background category because of an emphasis on instructional set.
2. There would be no change in the use of the Naming category since it is used a very small percent of the time.
3. There would be no change in the use of the Defining category. It is a little used category and change in sequence, not amount would be the result.
4. There would be an increase in the use of the General Example category because of identification and classification sequences.
5. There would be a decrease in the use of abstract examples since it is the category of largest use in classrooms.
6. There would be an increase in the use of the Concrete Example category because of the emphasis upon the concrete to abstract continuum of learning experiences.
7. There would be no change in the use of the Personal Example category. It is little used and was not emphasized in training.
8. There would be an increase in the use of the Negative Example category because of the definition by contrast and classification by constrast sequences.
9. There would be an increase in the use of the Amplification category because of its use in many classifying, process analysis, and comparison and contrast sequences.

10. There would be no change in the use of the Digression category since there would be less "expository digression" by the participants and perhaps more digression by identifying and correcting responses.

11. There would be no change in the use of the vividness category since it is used only a very small percent of the time or not at all.

12. There would be a decrease in the use of the Miscellaneous category since the main emphasis would be upon content elements and sequences.

A comparison of T_1 and T_3 observation scores by percent of category usage from both groups was made by means of the Mann-Whitney statistic for critical U's to establish what differences of significance at the .05 level there were in the pre-measures of the two groups on the twelve variables.

Following the comparison of pre-measure scores, change scores representing change of percent of category usage pre to post for each variable were computed for each category for the two groups. A comparison of these change scores by means of the Mann-Whitney statistic for critical U's was made to determine if change in percent of category usage was significant. One-tailed test of significance was used for testing directional predictions. The .05 level of significance was chosen for rejecting the null hypotheses.

Procedure for Examining the Discriminatory Power of the C.A. Observation Instrument

Post-training observation data was examined in an effort to identify elements and sequences present which resembledin codified form the organizations described in the training sequences. Teachers' lesson plan organizations were also examined where available to determine what kinds of sequences were planned in the content development.

Procedure for Examining the Relationship of Interaction and Content Development Characteristics of Communication Behaviors in the Classroom

The most useful display form for this examination was found to be the parallel columns of data illustrated in Figure 2. Content elements were identified with the corresponding interaction patterns in the parallel column. Some of the interaction variations have been summarized as they relate to the development of certain content elements.

FINDINGS AND IMPLICATIONS

Reliability Related to Control Sample Observations

Reliability for the Content Analysis Observations of the control sample data was determined by a comparison of the coded observations of the investigator and another judge trained in the system (13,58). Two tape-recordings of class sessions were selected randomly from the set of taped sources. The Scott coefficient was the statistic employed in the comparison for inter-observer reliability.

The original coded observations were made by the investigator. Subsequently, the judge's coded observations were compared to the original codings. The Scott coefficient of reliability for Tape 1 was .61 indicating "moderate" observer agreement. The coefficient for Tape 2 was .91 indicating a "good to high" agreement in the observations. The investigator also reviewed the two selected tapes and coded each of them twice more. This review by the investigator himself was made to indicate stability reliability of the observations over time. The two reliability coefficients for the investigator with himself on Tape 1 were .57 and .68 which

indicated moderate agreement. The coefficients on Tape 2 for the investigator were .83 and .87 which indicated good agreement in the repeated observations.

Reliability Related to Experimental Sample Observations

The tape-recorded pre and post treatment observations for the experimental group were coded by means of the Flanders' system of Interaction Analysis and the Content Analysis System. The investigator randomly selected a tape from the set to be checked for reliability of the interaction analysis coding and a tape to be checked for reliability of the content analysis coding. The Scott coefficient of reliability for Tape 7-B on interaction analysis was .92 which indicates high agreement of the observations. The Scott coefficient of reliability for Tape 5-B on content analysis was .87 which indicates "good to high" agreement in the observations.

Findings and Implications of Training Effect

The first comparison was made of pre-training observation data for both the experimental and control groups to determine whether or not the groups were significantly different on the twelve variables. Figure 4 is a graph of the total percentages for each category used by the two groups during the pre-training observations. These totals would indicate that the groups might be very similar on the twelve measured variables with the one possible exception of the personal example category. This graph, however, displays total group scores instead of individual scores of each group.

The Mann-Whitney statistic was used to compare the pre-training observation scores of the 11 individuals within the control group and the 7 individuals in the experimental group. Two tailed tests and a .05 level of significance was chosen for rejecting the null hypotheses.

Table 1 displays the values of U and U' for the Mann-Whitney test of pre-treatment measures on twelve variables from the two groups. No values of U or U' are significant at the .05 level for any of the twelve variables. Therefore, no null hypotheses can be rejected. For purposes of this investigation, the two groups may be treated as if they were drawn from the same population.

Change scores were computed by subtracting pre-training measures from post-training measures. Decrease changes were given a negative sign and increase scores a positive sign. A comparison of these scores was made in order to make inference of training effect.

When total change scores for each group on category usage were compared as in the graph in Figure 5, some clear differences in direction of change were apparent. For instance, the use of abstract examples showed an increase change of 15.4 percent for the control group while the same category showed a decrease change of 10.6 percent for the experimental group. However, some of these total differences were due in part to extreme scores by individuals in the group. When the Mann-Whitney test was applied to the individual scores within groups, fewer differences were identifiable.

Table 2 is a display of the values of U and U' for the Mann-Whitney test on the comparison of the 11 change scores of the control group and the 7 change scores

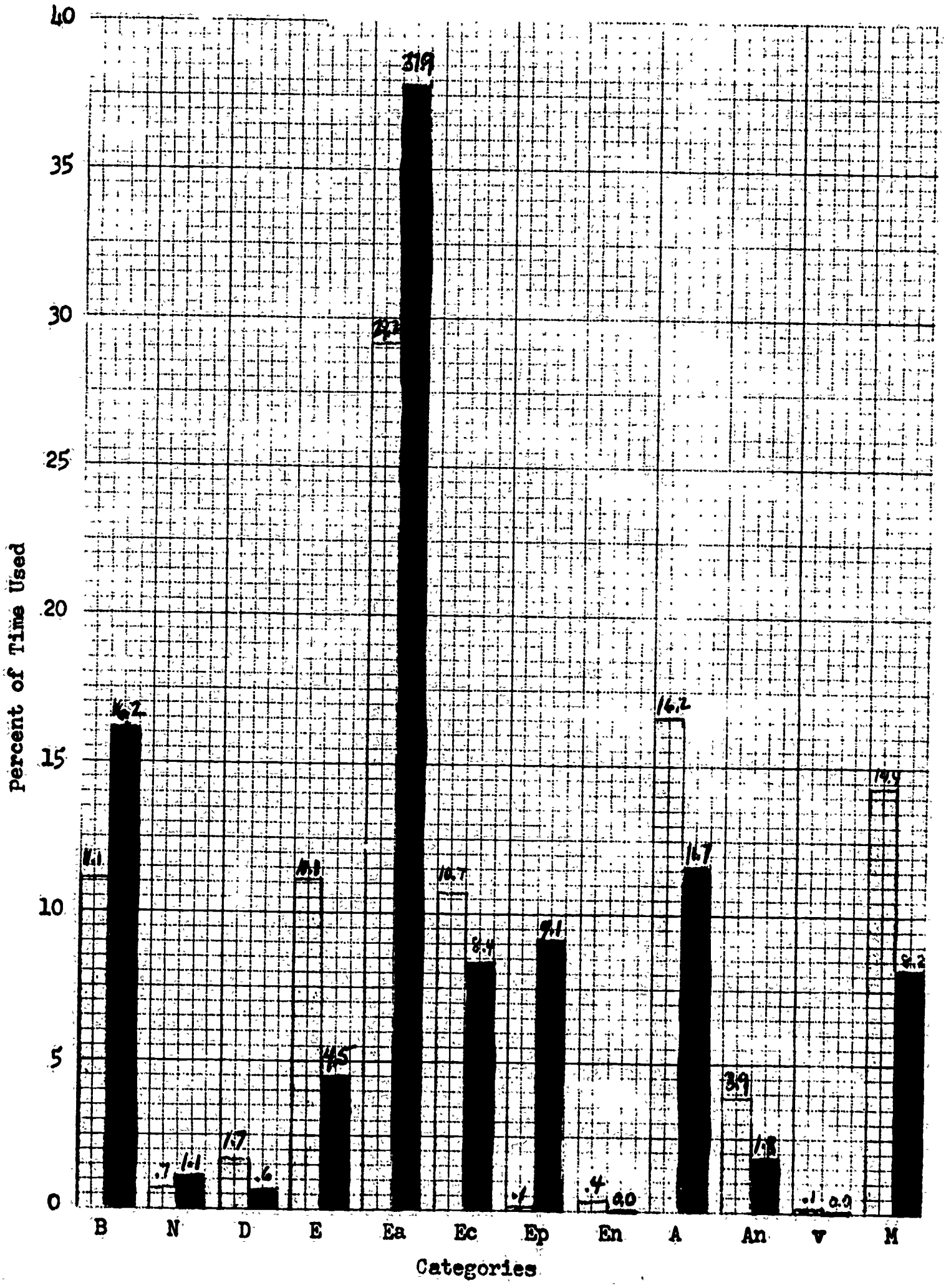

Figure 4 Between Group Comparison on Pre-measures

Control Group ☐ Experimental Group ■

TABLE 1

Values of U and U' by the Mann-Whitney test for Comparison of pre-treatment measures of the experimental and control groups on twelve measured variables. .05 level of significance.

Ho	dependent variable	U	U'	reject Ho	do not* reject Ho
1	Background	37	40		x
2	Naming	38.5	38.5		x
3	Defining	54.25	22.25		x
4	General Examples	49	28		x
5	Abstract Examples	31	46		x
6	Concrete Examples	37	40		x
7	Personal Examples	39	38		x
8	Negative Examples	49	28		x
9	Amplification	48	29		x
10	Digression	42	35		x
11	Vividness	52.5	24.5		x
12	Miscellaneous	57.5	19.5		x

*No critical values of U and U' are significant at .05 level.

∴ Null hypotheses cannot be rejected for any of the twelve variables

∴ Experimental and Control Groups may be treated as if they were drawn from the same population.

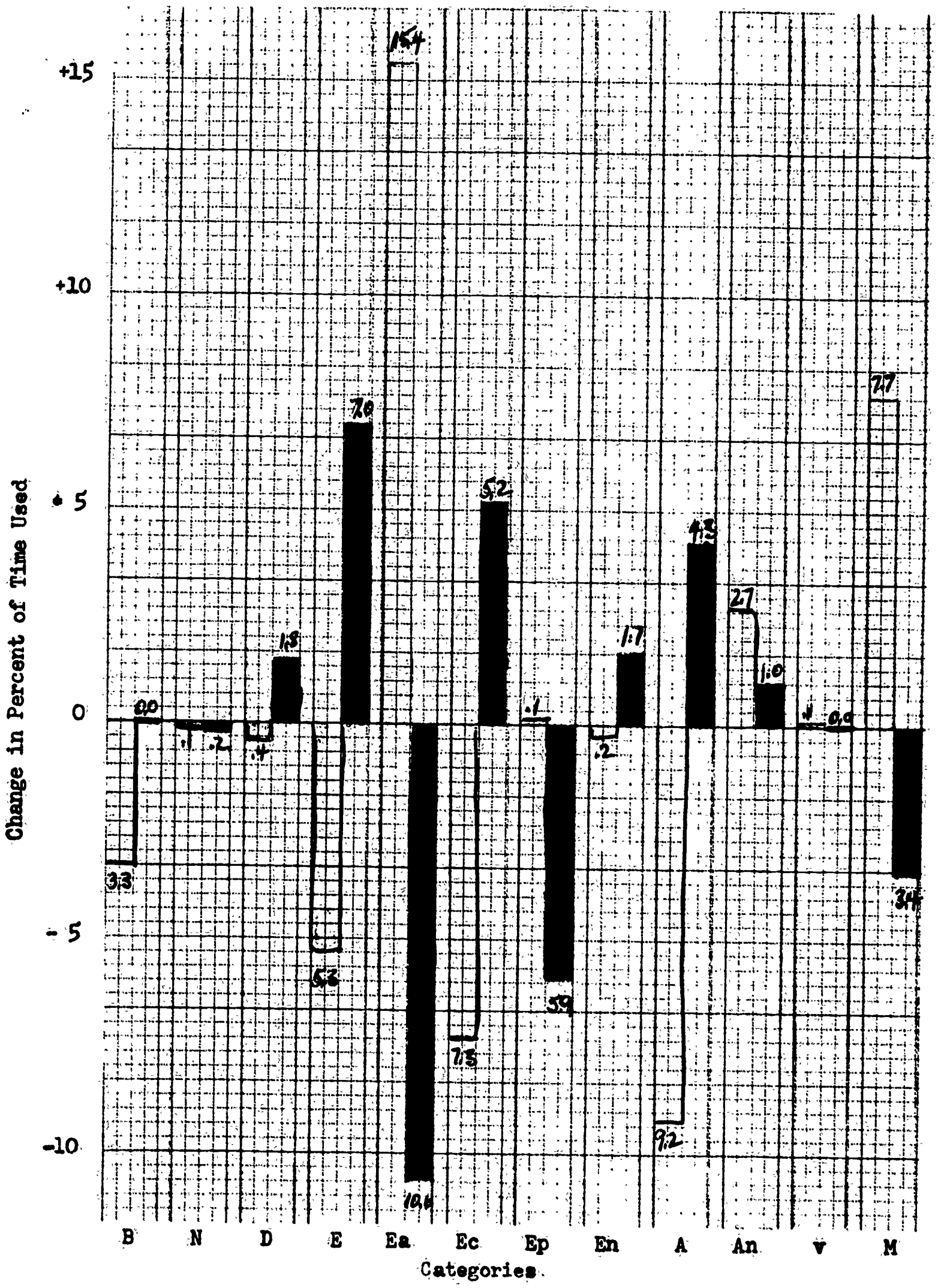

Figure 5 Change in Use of Categories by Groups

Control Group ☐ Experimental Group ■

TABLE 2

Values of U and U' for the Mann-Whitney test of Comparison of pre to post change scores for the Experimental and Control Groups on twelve measured variables. .05 level of significance.

Ho	one tailed test	two tailed test	dependent variable	U	U'	reject Ho	do not reject Ho
1	x		Background	26	51		x
2		x	Naming	44	33		x
3		x	Defining	24	53		x
4	x		General Examples	21	56		x
5	x		Abstract Examples	58	19*	x	
6	x		Concrete Examples	26.5	51.5		x
7		x	Personal Examples	35	52		x
8	x		Negative Examples	30	47		x
9	x		Amplification	19*	58	x	
10		x	Digression	45.5	31.5		x
11		x	Vividness	31.5	45.5		x
12	x		Miscellaneous	44	33		x

*Significant at .05 level of probability for one-tailed test.

∴ Ho rejected in favor of Ha in both cases.

∴ Change in variable use is due to training effect.

of the experimental group on each of the twelve variables. The change scores for use of abstract examples and amplification were significantly different at the .05 level for a one-tailed test. These scores differ significantly and in the predicted direction. Therefore, the conclusion is reached that these changes were due to treatment. As a result of training fewer abstract examples and more amplification was used in the classroom communication behaviors related to content development.

The use of abstract examples may have decreased as a result of training for two reasons: first, that the concrete to abstract continuum was emphasized in training; and second, that the category of most usage, abstract examples, might be reduced in time usage as other categories were emphasized. The use of amplification may have increased as a result of training because of the emphasis on relating, comparing, and contrasting processes in the sequences concerning classification.

The lack of a greater number of significant findings in the investigation in support of a training effect may be due to at least four reasons: First, percentage use of categories is an over-simplified form of evidence from which to infer training effect. Further, it does not account for sequences of categories but only overall usage. Some sequences may have been used but not to an extent that would influence category usage. Second, the teachers within the training group were encouraged to organize and sequence content according to the class situation as they deemed appropriate. This realistic latitude in planning and performance may have resulted in a considerable diffusion and variation of classroom behaviors which might modify evidence of a training effect. Third, the training sequence itself may have been lacking in effect. There was, for instance, little opportunity for simulated applications of the concepts. And fourth, the design left in question the control of certain sources of invalidity as previously discussed.

An additional finding related to the training session in the C. A. system and content development sequences was found in written reactions by teachers appraising the training experience and the potential of the system. A majority of teachers found most useful the category symbols for classifying and organizing content development activities in their lesson plans.

The graph in Figure 6 representing the total category usage for the experimental group only on pre and post-test measures, if considered by itself, would lend greater support to the predictions made about the effect of training. It shows, for instance, an increase in the use of general examples, concrete examples, negative examples, and amplification. It shows a decrease in usage of abstract examples and miscellaneous. There are also contradictions to the predictions made such as the usage of background, defining, etc.

These pre and post-test measures for the experimental group alone cannot fairly be analyzed apart from the control measures. However, when considered with the following section on the identification of content sequences, these changes may support the inference that teachers can plan and implement certain content development patterns in the classroom situation.

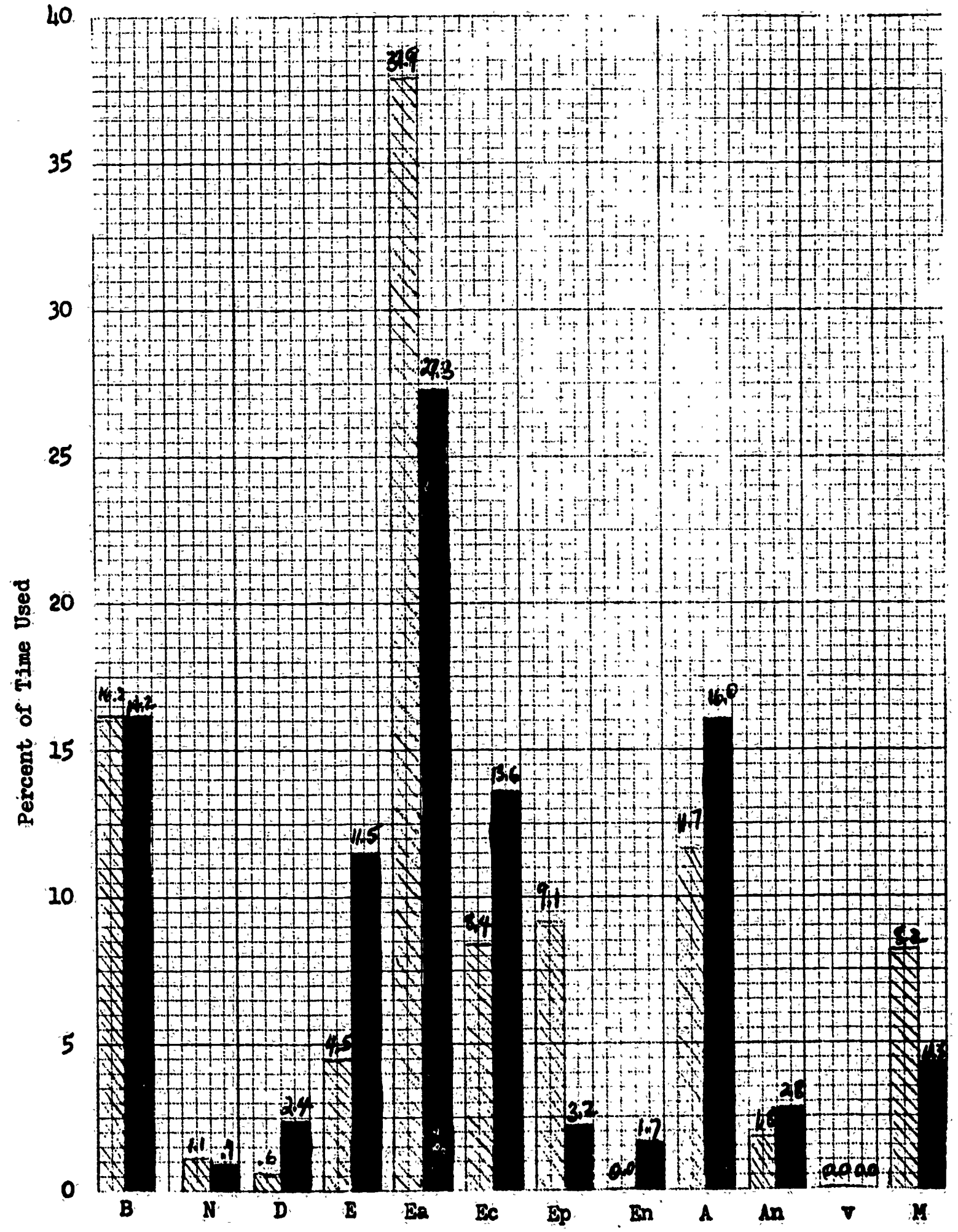

Figure 6 Comparison of Pre and Post Measures for Experimental Group Only

The Identification of Content Development Sequences

The discriminatory power of the C. A. System for use in the identification of content development sequences has been established to some extent in the prior studies. For instance, an enumeration sequence, a series of examples, is easily recognized in a data record of C. A. System category symbols. A classroom illustration which would appear in the data record as an enumeration sequence would be the review of assigned homework problems in math or the review of exercises in grammar.

Within the post-test observation data for the in-service training group, certain patterns of content organization and sequence are apparent and are congruent representations of training sequences. Four post-test episodes in subject areas of art, mechanical drawing, and language arts could be classed as deductive identification by enumeration sequences. These sequences began with Naming of the topic and Background content development. A general example or examples were identified and this was followed by specific examples, of a concrete, abstract, and personal nature which were representations of the general example. Two of the episodes included defining of the general examples within the deductive identification by enumeration sequence and one of the episodes was concluded with a series of negative examples followed by a restatement of the general example and a definition. This conclusion with the definition seemed to represent a synthesis level of content development activity when it appeared at the end of the episode.

Another post-test episode in the subject area of science used the deductive identification by enumeration sequence, general examples followed by specific examples as instances. This sequence, however, was combined, then, with deductive classification sequences in which students classified specific examples according to the appropriate general example which they represented.

The examination of the post-test recording data and the findings related reinforce: 1) the inference of training effect. 2) the discriminatory power of the Content Analysis Observation System to represent those sequences and strategies of content development in coded data form. This discriminatory power is, in fact, a supporting inference of the validity of the instrument.

The Relation of Interaction and Content Development Characteristics of Classroom Communication Behaviors

From an inspection of the recorded data using the Flanders' system and the Content Analysis System as the observation instruments, it is possible to describe some of the relationships of interaction and content development characteristics in the classroom episodes of the training group. The following represents some of the summary observations with regard to the five basic categories of the content analysis system:

Background was developed by extended teacher talk, category 5-5-5, or by repeated short question, answer, and confirmation sequences, 4-8-2, 4-8-2, etc. One instance using category 9, student initiated talk, was employed in the development of Background.

Naming of the topic or content figure of the class episode was usually done by the teacher in a short sequence of teacher talk, category 5-5.

Defining was accomplished by 5-5-5 sequences, 4-8-2 sequences, and also by extended interaction sequences such as 4-8-8-2-3-9 and 4-4-8-4-8-2. The

short sequences are likely to identify the recall forms of definitions while the extended interaction sequences are likely to relate to the development of a definition by formulation and synthesis.

Examples were developed by means of teacher talk, category 5. Demonstration or laboratory examples were developed by means of teacher lecture, direction giving, silent actions, and short question and answer exchanges. Homework examples enumerated are usually developed by short question, answer, and confirmation sequences of interaction.

Amplification has much to do with the processing of content as it deals mainly with relating, comparing, and higher order questions and evaluations. Whether the teacher or the students engage in amplifying activity may relate to the kind of cognitive activity potential in the learning situation. The interaction sequences for the development of Amplification in some sessions were all teacher talk. In other sessions short question, answer, and confirmation sequences were used to establish amplification. In other situations category 9, student initiated verbal behavior, was used in developing Amplification.

Appendix A, following the summary, includes one page of a post-test data record from the training group. Though it is not the complete record of a class session on the topic, "Introduction to Perspective", the reader will be able to identify the beginning of a deductive identification by enumeration sequence.

SUMMARY

The purpose of the study was: 1) to determine the effect of training of teachers in the use of elements and sequences of strategies for content development through classroom communication behaviors. 2) to determine the discriminatory power of the content analysis observation instrument to identify content sequences developed in the classroom communication. 3) to describe some of the relationships of content development characteristics and interaction characteristics of classroom communication behaviors found in this sample.

An in-service training experience was provided for practicing teachers in the principles, elements, and procedures of the Content Analysis System and strategies of content sequences including enumeration, deductive and inductive organizations for identifying and classifying, defining sequences, process analysis, and comparison and contrast. Pre and post audio recordings of class sessions by the experimental teachers were coded and compared with data from a control group by means of the Mann-Whitney statistic.

Post-treatment sample classroom recordings were coded by means of the Flanders' system of Interaction Analysis and the Content Analysis observation instrument. These contiguous data records were inspected to determine: 1) if content development sequences similar to those in the training experience could be identified. and 2) what relationships could be identified between the interaction patterns and the content development character of the communication behaviors of the teachers and students in the classroom.

The increase in the use of the Amplification category and the decrease in the use of the Abstract Examples when compared with the control group were significant at the .05 level. These changes were considered attributable to training. Content sequences comparable to those in the training experience were identifiable within the coded data generated from observation of post-treatment classroom episodes. Certain relationships of interaction characteristics of communication behavior can be identified when related to the five basic categories of the Content Analysis System.

This study has contributed evidence of the discriminatory power of the Content Analysis System to identify content development sequences. This capability of the system is an inference of its validity. The study has also contributed evidence that teachers can learn to develop content sequences through communication behaviors in the classroom and that there is a relationship between the interaction character and the content character of communication.

Some directions for further investigation might be: 1) to explore the relationships between content development and interaction characteristics of communication behaviors and the cognitive styles of teachers and students. 2) to examine the relationships between content sequences, interaction characteristics, and achievement or concept attainment. 3) to identify the relationships of content elements and sequences and the levels of objectives intended in learning situations.

APPENDIX A

PARTIAL DATA RECORD ILLUSTRATING CONTINGUOUS INTERACTION ANALYSIS CODING AND CONTENT ANALYSIS CODING

Teacher 7 School S Date of recording 3/3/70 Tape no. 7B Side 1

Tape recorder counter nos. 000 to 320 Grade level of class 11 Subject area Architectural Drawing

Topic Introduction to Perspective Background _____ Media Drawing on board

IA	CD
10	M
6	N
5	N
5	M
5	M
5	M
5	M
5	M
5	M
5	M
5	M
5	M
5	M
5	N
5	N
5	M
5	M
5	M

IA	CD
5	M
5	M
5	N
5	M
5	M
6	M
5	B
5	B
5	B
5	B
5	B
5	B
5	B
5	B
5	B
5	B
5	N

IA	CD
5	D
5	D
5	B
5	B
5	B
5	B
5	B
4	B
4	B
4	B
8	B
2	B
4	B
8	B
4	B
3	B
2	B
4	B
10	B

IA	CD
4	B
8	B
4	B
8	B
3	B
8	B
5	B
8	B
2	B
4	B
5	B
2	B
2	B
5	B
3	B
3	B
2	B
3	B
5	B
5	B

IA	CD
5	B
5	B
5	A
5	A
5	A
5	A
5	A
5	E
5	E
4	A
3	A
4	A
8	A
4	A
8	A
2	A
3	A
4	E

IA	CD
8	D
5	D
5	E
5	D
5	E
5	D
5	E
5	D
5	B
5	B
5	B
5	B
5	B
4	A
4	A
4	A
8	A
2	A
5	A

defining classes

IA	CD
9	A
4	A
5	A
5	E
5	E
5	E
5	E
5	E
5	E
5	E
7	E
5	E
4	E
8	E
2	E
5	E

drawing

class

IA	CD
8	E
2	E
5	E
5	E
4	E
8	A
3	A
4	A
10	A
6	A
8	A
2	A
4	A
8	A
2	A
4	A
8	A
2	A
5	A
5	A

concrete

digression

generalization

IA	CD
5	A
5	A
5	A
5	A
4	E
8	E
2	E
3	E
5	E
2	E
5	E
5	E
5	E
5	E
5	E
5	A
5	A

(abstr.)

IA	CD
5	A
4	E
4	E
8	E
3	E
8	E
2	E
4	E
4	E
8	E
2	E
4	E
10	E
5	E
4	E
9	E
4	E
8	E
2	E
4	E

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